WHAT IS CLAIMED IS:

1. A method for producing a polishing pad substrate comprising:

(a) combining a polymer resin with a supercritical gas to produce a single-phase solution, wherein the supercritical gas is generated by subjecting a gas to an elevated temperature and pressure, and

(b) forming a polishing pad from the single-phase solution.

2. The method of claim 1, wherein the gas does not contain C-H bonds.

3. The method of claim 2, wherein the gas comprises nitrogen, carbon dioxide, or combinations thereof.

4. The method of claim 1, wherein the polymer resin is selected from the group consisting of thermoplastic elastomers, thermoplastic polyurethanes, polyolefins, polycarbonates, polyvinylalcohols, nylons, elastomeric rubbers, styrenic polymers, polyaromatics, fluoropolymers, polyimides, cross-linked polyurethanes, cross-linked polyolefins, polyethers, polyesters, polyacrylates, elastomeric polyethylenes, polytetrafluoroethylenes, polyethyleneteraphthalates, polyimides, polyaramides, polyarylenes, polystyrenes, polymethylmethacrylates, copolymers and block copolymers thereof, and mixtures and blends thereof.

5. The method of claim 1, wherein the polishing pad is formed by creating a thermodynamic instability in the single-phase solution sufficient to produce greater than about 10^5 nucleation sites per cm^3 of the solution.

6. The method of claim 1, wherein the amount of supercritical gas is about 0.01% to about 5% of the total volume of the single-phase solution.

7. The method of claim 1, wherein the gas is converted to the supercritical gas before combination with the polymer resin.

8. The method of claim 1, wherein the gas is converted to the supercritical gas after combination with the polymer resin.

9. The method of claim 3, wherein the gas is carbon dioxide, the temperature is about 150 °C to about 250 °C, and the pressure is about 7 MPa to about 35 MPa.

10. The method of claim 1, wherein the polishing pad is formed from the single-phase solution using a technique selected from the group consisting of extrusion into a polymer sheet, co-extrusion of multilayer sheets, injection molding, compression molding, blow molding, blown film, multilayer blown film, cast film, thermoforming, and lamination.